

NASA TECHNICAL MEMORANDUM

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Compiled by O. L. White
Management Services Office

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FOREWORD

In accordance with the NASA Space Act of 1958 the MSFC has provided for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof.

Since July 1, 1960, when the George C. Marshall Space Flight Center was organized, the reporting of scientific and engineering information has been considered a prime responsibility of the Center. Our credo has been that "research and development work is valuable, but only if its results can be communicated and made understandable to others."

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GEORGE C. MARSHALL SPACE FLIGHT CENTER
Marshall Space Flight Center, Alabama

FY 1979 SCIENTIFIC AND TECHNICAL REPORTS,
ARTICLES, PAPERS, AND PRESENTATIONS

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RP-1029 September 1978
The PR2D (Place, Route in 2-Dimensions) Automatic Layout Computer Program Handbook. Teddy M. Edge. Electronics and Control Laboratory.
N79-71512

Place, Route in 2-Dimensions (PR2D) is a standard cell automatic layout computer program for generating Large Scale Integrated/Metal Oxide Semiconductor (LSI/MOS) arrays. It is one of the components in the NASA/MSFC Computer Aided Design and Test system (CADAT). The program has been utilized successfully for a number of years in both Government and private sectors but until now had been undocumented. This material describes the compilation, loading, and execution of the program on a Sigma V CP-V operating system located at the NASA/MSFC Electronics and Control Facility. This material is also intended to aid in the conversion and running of the program on other data processing systems.

TM-78186** August 1978
Cost Analysis of New and Retrofit Hot-Air Type Solar Assisted Heating Systems. Rodney D. Stewart and Billy J. Hawkins. Systems Analysis and Integration Laboratory.
N79-10519

A detailed cost analysis/cost improvement study has been performed on two Department of Energy/National Aeronautics and Space Administration Operational Test Sites to determine actual costs and potential cost improvements of new and retrofit hot-air type solar assisted heating and hot water systems for single family sized structures. This analysis concentrates on the "first-cost" of a system which includes procurement, installation, and integration of a solar assisted heating and hot water system on a new or retrofit basis; it also provides several cost projections which can be used as inputs to payback analyses, depending upon the degree

of optimism or future improvements assumed. Cost definitions were developed for five categories of cost, and preliminary estimates were developed for each. The costing methodology, approach, and results together with several candidate low cost designs are described.

TM-78187 August 1978
SRB Materials and Processes Assessment from Laboratory and Ocean Environmental Tests. Prepared from information furnished by Materials and Processes Laboratory and Electronics and Control Laboratory.
N78-30165

The Materials and Processes Laboratory at the Marshall Space Flight Center recognized early in the Shuttle Program that material performance on a long-term basis would be critical to the success of the Shuttle and its goal of reusable components. The laboratory instituted, in-house, a comprehensive series of materials tests simulating exposure of the refurbishable components of the propulsion system to expected flight and marine environments. These tests were subsequently expanded to include ocean environment exposure of these laboratory type samples. An Integrated Test Bed of 3.048 m (10 ft) diameter by 2.438 m (8 ft) high was also fabricated in support of this program. The Integrated Test Bed allowed large scale evaluation of principal manufacturing, insulating, cleaning and refurbishment methods.

This report gives the results and an assessment of the series of ocean environment tests that were conducted at Panama City and Kennedy Space Center, Florida, during the Spring and Summers of 1976 and 1977.

TM-78192 September 1978
User's Manual for Large-Scale Integrated Circuit Layout Check Program. Electronics and Control Laboratory.
N79-78978

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This document describes a computer program that checks for correctness with the output of the PRF (Place-Route-Fold) against the net list input to the PRF program. Also included are a description of the computer program and an example computer run.

TM-78193 August 1978
An Induced Environment Contamination Monitor for the Space Shuttle. Edited by Edgar R. Miller and Rudolf Decher. Space Sciences Laboratory. N78-32172

The Induced Environment Contamination Monitor (IECM) is a set of ten instruments integrated into a self-contained unit. The IECM is scheduled to fly as part of the Demonstration Flight Instrumentation (DFI) on Shuttle Orbital Flight Tests (OFT) 1 through 6 and on Spacelabs 1 and 2 as part of the Verification Flight Instrumentation (VFI).

NASA began strong manned mission contamination control efforts for the Skylab mission and, recognizing the possible limiting effects induced contamination might have on sophisticated observational programs planned for the 1980's, committed to an effort to insure that the induced environment would not be a problem.

The purpose of the IECM is to measure the actual environment to determine whether the strict controls placed on the Shuttle system have solved the contamination problem. The IECM will operate during prelaunch, ascent, on-orbit, descent, and postlanding. The on-orbit measurements are molecular return flux, background spectral intensity, molecular deposition, and optical surface effects. During the other mission phases dew point, humidity, aerosol content, and trace gas will be measured as well as optical surface effects and molecular deposition. These measurements will be made with ten separate instruments: Humidity Monitor, Dew Point Hygrometer, Air Sampler, Cascade Impactor, Passive Sample

Array, Optical Effects Module, Temperature-Controlled Quartz Crystal Microbalance, Cryogenic Quartz Crystal Microbalance, Camera/Photometer, and Mass Spectrometer. Each instrument is described in detail.

The IECM systems and thermal design are discussed. Preflight and ground operations are presented together with associated ground support equipment. Finally, flight operations and data reduction plans are given.

TM-78194 September 1978
The MSFC Silicon Gate Silicon-On-Sapphire Standard Cell Library. Electronics and Control Laboratory. N79-79569

This document is a pictorial representation of the MSFC Silicon-On-Sapphire Standard Cell Library. The cells are intended to be used with the PR2D (Place, Route in 2 Dimensions) Automatic Layout Computer Program.

TM-78195 June 1977
Aerodynamic Roll Characteristics of a 0.00548 Scale 146-Inch Solid Rocket Booster Reentry Configuration (MSFC Model Number 486) Over a Portion of the Reentry Flight Regime in the NASA/MSFC 14-Inch Trisonic Wind Tunnel. P. E. Ramsey. N78-32173

An experimental investigation (SA21F, TWT 645) was conducted in the MSFC 14-inch TWT to study the roll characteristics of a 0.00548 scale model of the 146-inch Shuttle Solid Rocket Booster. The primary objective of the test was to obtain improved and more accurate rolling moment data on the Solid Rocket Booster by utilizing a sensitive single component roll balance (No. 247). This data will hopefully be useful in determining roll characteristics of the SRB with protuberances consisting of ring stiffeners, separation motors, actuator supports, hold-down posts, and cable systems tunnel.

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Data were obtained for a single nose-mounted sting. The angle of attack range consisted of angles from 150° to 190° ; roll angles consisted of angles from 0° to $337\frac{1}{2}^\circ$ in increments of $22\frac{1}{2}^\circ$; and Mach numbers were 1.46, 1.96, 2.74 and 3.48.

TM-78196** August 1978
Rankine Cycle Machines for Solar Cooling. Hoyt M. Weathers. Special Projects Office. N79-10524

The Department of Energy of the United States of America has initiated a vigorous effort to develop and demonstrate practical uses of solar energy to heat and cool buildings, to process agricultural products, and to provide thermal and electrical energy for industry. One significant part of this effort is the research, development, and demonstration of Rankine cycle machines using fluids heated by solar energy rather than by coal, petroleum, natural gas, or nuclear fuels.

TM-78197 October 1978
NASA's AVE VII Experiment: 25-mb Sounding Data. J. Greg Davis, Henry E. Fuelberg, and Robert E. Turner. Space Sciences Laboratory. N79-10666

This report describes the AVE VII Experiment and presents tabulated rawinsonde data at 25-mb intervals from the surface to 25 mb for the 24 stations participating in the experiment. Soundings were taken between 0000 GMT May 2 and 1200 GMT May 3, 1978. The methods of data processing and the accuracy are briefly discussed. Selected synoptic charts prepared from the data are presented as well as an example of contact data. A tabulation of adverse weather events that occurred during the AVE VII period, including freezing temperatures, snow, tornadoes, damaging winds, and flooding, is presented.

TM-78198 September 1978
Spacelab Mission 2 Experiment Descriptions. Edited by K. Stuart Clifton. Space Sciences Laboratory. N79-12122

A brief description is presented of each of the 13 experiments selected to fly aboard Spacelab 2. The experiments were selected in response to an Announcement of Opportunity issued by NASA Headquarters for the second Spacelab mission.

TM-78199** August 1978
Solar Tracking Control System "Sun Chaser." D. R. Scott and P. R. White. Electronics and Control Laboratory. N79-10514

The solar tracking control system ("Sun Chaser") is believed to be an improved method of tracking the Sun in all types of weather conditions. The Sun Chaser will follow the Sun from east to west in clear or cloudy weather, and reset itself to the east position after sundown in readiness for the next sunrise.

A description of the Sun Chaser hardware and its operation together with results is presented.

TM-78200 September 1978
Photolithography for Automatic Processing of Integrated Circuits. Bobby W. Kennedy. Electronics and Control Laboratory.

This report presents a discussion of photolithography including the wafer carriers, photoresist coater, pre-bake station, mask aligner, photoresist developer, hard bake, and inspection.

TM-78201 October 1978
Arc Termination Cracks in Inconel 718 and Incoloy 903. E. Bayless, J. McCaig,

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and R. Poorman. Materials and Processes
Laboratory. N79-10184

Inconel 718 and Incoloy 903 are nickel base, heat resistant alloys that are used extensively for welded Shuttle engine components. The welding associated with these components has revealed solidification cracking characteristics at weld termination points known as "crater cracking." These crater cracks, if not detected and removed, may cause costly component failure. To better understand this characteristic, welding termination techniques were studied and methods developed to eliminate crater cracks. It was determined that weld termination solidification cracking can be eliminated by controlled decrease of welding current, welding voltage, wire feed, and travel speed.

TM-78202 October 1978
The Large Scale Microelectronics Computer Aided Design and Test (CADAT) System. John M. Gould. Electronics and Control Laboratory.

This report describes a large scale microelectronic Computer Aided Design and Test system referred to as CADAT. CADAT consists of a number of computer programs written in FORTRAN that provide the capability to simulate, lay out, analyze, and create the artwork for large scale microelectronics. The function of each software component of the system is described with references to specific documentation for each software component.

TM-78203 October 1978
FY 1978 Scientific and Technical Reports, Articles, Papers, and Presentations. Compiled by O. L. White. Management Services Office, Administration and Program Support. N79-13915

This document presents formal NASA technical reports, papers published in technical

journals, and presentations by MSFC personnel in FY 78. It also includes papers of MSFC contractors.

After being announced in STAR, all of the NASA series reports may be obtained from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

The information in this report will be of value to the scientific and engineering community in determining what information has been published and what is available.

TM-78204* December 1978
Testing and Environmental Exposure of Parachute Materials for the Solid Rocket Booster Decelerator Subsystem. B. K. Tannehill. Materials and Processes Laboratory. N79-14215

This report describes static tests and evaluation of nonmetallic materials proposed for use in parachutes for recovery of Solid Rocket Boosters used in the Space Shuttle program. Literature survey and manufacturer and vendor contacts led to the choice of nylon as the fabric most capable of withstanding the extreme loads and environmental conditions during repeated use. The material tests included rupture strength, elongation, abrasion resistance, shrinkage, environmental exposure, and degradation levels. Rinsing and drying procedures were also investigated and a salt-free level for nylon recommended in preparation for reuse. In all possible cases, worst-case conditions were used (e.g., inflation loads, seawater exposure for 3 days per drop-recovery, etc.). From these tests the number of parachute drop-recoveries and reuse cycles may be projected.

Dynamic conditions such as drop tests are being performed by other elements of the Marshall Space Flight Center in conjunction with the Air Force and are still in progress.

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TM-78205 September 1978
Mossbauer Study in Thin Films of FeSi₂
and FeSe Systems. W. T. Escue, Kamna
Aggarwall, and R. G. Mendiratta. Elec-
tronics and Control Laboratory.

N79-10919

Thin films of FeSi₂ and FeSe were studied Mossbauer spectroscopically. Information regarding dangling bond configuration and nature of crystal structure in thin films has been derived. A significant influence of crystalline aluminum substrate on film structure has been observed.

TM-78206 October 1978

MSFC Hot Air Collectors — Final Report. Kenneth Anthony. Structures and Propulsion Laboratory.

N79-12556

The final report on the MSFC hot air collector consists of the description of the collector, history of development, a history of the materials development and a program summary.

It is well known that one of the major obstacles in widespread application of solar energy is the initial cost of the system required for the utilization of this energy. The major portion of the solar energy system cost is the collector. Since the collector is the "heart" of the system and the most costly subsystem, reducing the cost of producing collectors in large quantities is a major goal. This solar collector is designed for economy and simplicity. In summary, the purpose of this invention is to heat air and/or water cheaply and efficiently through the use of solar energy.

TM-78207 November 1978
Nonterrestrial Material Processing and Manufacturing of Large Space Systems. Georg F. von Tiesenhausen. Advanced Systems Office.

N79-14120

A number of NASA sponsored summer studies and independent university efforts indicated the possibility that large space system material delivery and construction from lunar sources may be of a potential economic and environmental advantage. Presently this potential is under investigation to provide NASA with supplemental information required to arrive at optimum large space system options and programs, for the time period around the turn of the century. This report attempts to provide pertinent and readily usable information on the extraterrestrial processing of materials and manufacturing of components and elements of these planned large space systems from preprocessed lunar materials which are made available at a processing and manufacturing site in space.

The activities at the space manufacturing facility consist of final processing of the incoming pre-processed material to commercial grade raw material and of performing a series of large scale manufacturing processes which would include the following products: large structures to support energy generating and large communication systems in space, large area solar cell blankets, radio frequency generators, and electrical equipment. These processing and manufacturing facilities are highly automated and are sized for annual outputs of at least 10⁵ metric tons of products. Required facilities, equipment, machinery, energy and manpower are defined.

TM-78208 December 1978
Transfer Function Tests of the Joy Longwall Shearer. Paul H. Fisher, Jr. Electronics and Control Laboratory.

N79-14504

A series of operational tests was performed in March 1977, on the Joy longwall shearer located at the Bureau of Mines in Bructon, Pennsylvania. The purpose of these

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tests was to determine the transfer function and operational characteristics of the system. These characteristics will be used to generate a simulation model of the longwall shearer used in the development of the closed-loop vertical control system.

TM-78209 November 1978
An Experiment to Verify that the Weak Interactions Satisfy the Strong Equivalence Principle. Peter B. Eby. Space Sciences Laboratory. N79-13830

This report proposes the construction of a clock based on the beta decay process to test for any violations by the weak interaction of the strong equivalence principle. The basic idea is to determine whether the weak interaction coupling constant β is spatially constant or whether it is a function of gravitational potential U . The clock will be constructed by simply counting the beta disintegrations of some suitable source. The total number of counts will be taken as a measure of elapsed time. The accuracy of the clock will be limited by the statistical fluctuations in the number of counts N , which is equal to \sqrt{N} . Thus, to obtain an accuracy of 1 part in 10^6 one needs a total number of counts of 10^{12} , feasible number to actually measure in a few weeks' time. Increasing N gives a corresponding increase in accuracy. It is proposed to use a source based on the electron capture process so as to avoid low energy electron discrimination problems. Solid state and gaseous detectors are being considered. While the accuracy of this type of beta decay clock is much less than clocks based on the electromagnetic interaction, there is a corresponding lack of knowledge of the behavior of β as a function of gravitational potential. No predictions from nonmetric theories as to variations in β are available as yet, but they may occur at the U/C^2 level.

TM-78210 November 1978
Continuous-Flow Electrophoresis: Membrane-Associated Deviations of Buffer pH and Conductivity. Adam J. K. Smolka and Janice K. McGuire. Space Sciences Laboratory. N79-13101

The deviations in buffer pH and conductivity which occur near the electrode membranes in continuous-flow electrophoresis were studied in the Beckman charged particle electrophoresis system and the Hannig FF-5 preparative electrophoresis instrument. The nature of the membranes separating the electrode compartments from the electrophoresis chamber, the electric field strength, and the flow rate of electrophoresis buffer were all found to influence the formation of the pH and conductivity gradients. Variations in electrode buffer flow rate and the time of electrophoresis were less important. The results obtained supported the hypothesis that a combination of Donnan membrane effects and the differing ionic mobilities in the electrophoresis buffer was responsible for the formation of the gradients. The significance of the results for the design and stable operation of continuous-flow electrophoresis apparatus is discussed.

TM-78211 November 1978
Description of the Three Axis Low-g Accelerometer Package. A. J. Amalavage, E. H. Fikes, and Eugene H. Berry. Electronics and Control Laboratory. N79-14152

This document describes the three axis low-g accelerometer package designed for use on the Space Processing Application Rocket (SPAR) Program. The package consists of the following major sections: (1) three Kearfott model 2412 accelerometers mounted in an orthogonal triad configuration on a

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temperature controlled, thermally isolated cube, (2) the accelerometer servoelectronics (printed circuit cards PC-6 through PC-12), and (3) the signal conditioner (printed circuit cards PC-15 and PC-16).

The measurement range is 0 ± 0.031 g with a quantization of 1.1×10^{-7} g. The package has been flown successfully on six SPAR launches with the Black Brant booster. These flights provide approximately 300 s of free fall or zero-g environment.

TM-78212 December 1978
25 kW Power Module Updated Baseline
System. Science and Engineering.
N79-15247

In September 1977, MSFC published a report entitled "25 kW Power Module Preliminary Definition," which depicted a proposed baseline system. Since then, analyses and trades have been performed to improve the original baseline. This report describes a suggested new baseline that incorporates modifications to the September 1977 system.

TM-78213 January 1979
Preliminary Characterization of a One-Axis Acoustic System. W. A. Oran, D. A. Reiss, L. H. Berge, and H. W. Parker. Space Sciences Laboratory.
N79-16650

Measurements have been made of the acoustic fields and levitation forces produced along the axis of a single-axis resonance system. The system consisted of a St. Clair generator and a planar reflector. The levitation force was measured for bodies of various sizes and geometries (i.e., spheres, cylinders, and discs). The force was found to be roughly proportional to the volume of the body until the characteristic body radius reaches $\sim 2/k$ (k = wave number).

The acoustic pressures along the axis were modeled using Huygens' principle and a method of imaging to approximate multiple reflections. The modeled pressures were found to be in reasonable agreement with those measured with a calibrated microphone.

TM-78214 December 1978
Materials Processing in Space Program
Tasks. Edited by Eugene C. McKannan.
N79-16889

This report is a list of active research tasks as of the end of 1978 of the Materials Processing in Space Program of the Office of Space and Terrestrial Applications, involving several NASA Centers and other organizations. The purpose of this compilation is to provide an overview of the program scope for managers and scientists in industry, university and government communities. The report is structured to include an introductory description of the program, its history, strategy and overall goal; identification of the organizational structures and people involved; and a description of each research task. Tasks are categorized by ground based research according to four process areas. Research and flight experiments are listed together. Cross references to the performing organizations and principal investigators are provided. It is expected that any questions on specific tasks will be directed to the individual involved. Any corrections, additions or general comments should be directed to the editor at the George C. Marshall Space Flight Center. Abstracts of completed tasks are listed separately in a "Bibliography of Space Processing Applications," NASA Technical Memorandum 78167, April 1978.

TM-78215 January 1979
A Programmable Power Processor for a
25-kW Power Module. Roy Lanier, Jr.,
Robert E. Kapustka, and John R. Bush,
Jr. Electronics and Control Laboratory.
N79-24441

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This report presents a discussion of the power processor for an electrical power system for a 25-kW Power Module that could support the Space Shuttle program during the 1980's and 1990's and which could be a stepping stone to future large space power systems. Trades that led to the selection of a microprocessor-controlled power processor are briefly discussed. Emphasis is given to the power processing equipment that uses a microprocessor to provide versatility that allows multiple use and to provide for future growth by reprogramming output voltage to a higher level (to 120 V from 30 V). Efficiency data from a breadboard programmable power processor are presented, and component selection and design considerations are also discussed.

TM-78216 January 1979
Electrets Used in Measuring Rocket Exhaust Effluents from the Space Shuttle's Solid Rocket Booster During Static Test Firing, DM-3. Michael Susko. Space Sciences Laboratory.
N79-17356

The purpose of this experimental research was to compare Marshall Space Flight Center's electrets with Thiokol's fixed flow air samplers during the Space Shuttle Solid Rocket Booster Demonstration Model-3 static test firing on October 19, 1978, at Thiokol's desert static test site near Brigham City, Utah.

The measurement of rocket exhaust effluents by Thiokol's samplers and MSFC's electrets indicated that the firing of the Solid Rocket Booster had no significant effect on the quality of the air sampled. The highest measurement by Thiokol's samplers was obtained at Plant 3 (site 11) approximately 8 km at a 113-degree heading from the static test stand.

At sites 11, 12, and 5, Thiokol's fixed flow air samplers measured 0.0048, 0.00016, and

0.00012 mg/m³ of Cl. These measurements converted to 0.0016, 0.0008, and 0.0004 ppm, or an average of 0.0009 ppm. Alongside the fixed flow measurements, the electret counts from X-ray spectroscopy were 685, 894, and 719 counts. After background corrections, the counts were 334, 543, and 368, or an average of 415 counts. An additional electret, E20, which was the only measurement device at a site approximately 20 km northeast from the test site where no power was available, obtained 901 counts. After background correction, the count was 550. Equating the average counts of 415 from the electret and 0.0009 ppm from Thiokol's samplers, the 550 counts convert to 0.0011 ppm. Again, there was no measurement of significant rocket exhaust effluents at the test site.

Electrets can be used to obtain measurements in areas where no power is available. Consequently, the electret is a valuable complementary instrument for measuring rocket exhaust effluents in areas where other measuring devices may not be able to assess the contaminants.

TM-78217 January 1979
Descriptions of Space Processing Applications Rocket (SPAR) Experiments. Edited by R. J. Naumann. Space Sciences Laboratory. N79-16888

This report presents experiment descriptions for all of the Space Processing Applications Rocket experiments, including those flown on previous Space Processing Applications Rocket flights as well as those under development for future flights. The descriptions summarize the experiment objective, rationale, approach, and results or anticipated results.

TM-78218** January 1979
Development, Testing, and Certification of Calmac Mfg. Corp. Solar Collector and Solar Operated Pump — Final

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Report. John C. Parker. Solar Heating
and Cooling Projects Office. N79-17338
N79-17338

This report presents a summary of the final results of Contract NAS8-32253 with the Calmac Manufacturing Corporation of Englewood, New Jersey, for the additional development work on their existing rubber tube solar collector and solar operated pump for use with solar heating and cooling systems. It discusses the intended use of the final report, describes the development hardware, lists deliverable end items, deals with problems encountered during fabrication and testing, and includes certification statements of performance.

This report shows that the products developed are marketable and suitable for public use, with limitations.

TM-78219** March 1979
Development, Testing, and Certification
of the Northrup, Inc., ML Series Concen-
trating Solar Collector Model NSC-01-
0732 — Final Report. John C. Parker.
Solar Heating and Cooling Projects
Office. N79-21618

This report presents a summary of the final results of Contract NAS8-32251 with Northrup, Inc., of Hutchins, Texas, for the additional development work on their existing ML Series concentrating solar collector Model NSC-01-0732 for use with solar heating and cooling systems. It discusses the intended use of the final report, describes the development hardware, lists deliverable end items, deals with problems encountered during fabrication and testing, and includes certification statements of performance.

This report shows that the products developed are marketable and suitable for public use.

TM-78220 February 1979
Propellant Grain Dynamics in Aft Attach
Ring of Shuttle Solid Rocket Booster.
V. Verderaime. Systems Dynamics
Laboratory. N79-20263

This report presents an analytical technique for implementing simultaneously the temperature, dynamic strain, real modulus, and frequency properties of solid propellant in an unsymmetrical vibrating ring mode. All dynamic parameters and sources are defined for a free vibrating ring-grain structure with initial displacement and related to a forced vibrating system to determine the change in real modulus. Propellant test data application is discussed.

The technique was developed to determine the aft attach ring stiffness of the Shuttle booster at lift-off.

TM-78221 January 1979
Weld Bead Reinforcement Removal — A
Method of Improving the Strength and
Ductility of Peaked Welds in 2219-T87
Aluminum Alloy Plate. Charles V.
Lovoy. Materials and Processes
Laboratory. N79-21351

This report presents the results of a study to determine the degree to which the ductility and tensile properties of peaked welds could be enhanced by removing the reinforcing bead and fairing the weld nugget into the adjacent parent metal. The study employed 2219-T87 aluminum alloy plate, tungsten inert gas (TIG) welding, and 2319 filler wire.

The study concluded that significant improvements in peak weld, ultimate strength, and ductility can be obtained through removal and fairing of the weld reinforcing bead. The specimens so treated and tested in this program exhibited ultimate strength improvements of 2 to 3 percent for peak angles of 5.8 to 10 degrees

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and 10 to 22 percent for welds with peak angles of 11.7 to 16.9 degrees. It was also determined that removal of the weld bead enhanced the ability of peaked welds to straighten when exposed to cyclic loading at stress levels above the yield strength.

TM-78222 February 1979
Performance Characteristics of a 1.8 by 3.7 meter Fresnel Lens Solar Concentrator. L. J. Hastings and S. L. Allums.

Line-focusing acrylic Fresnel lenses with application potential in the 200 to 370 C range were analytically and experimentally investigated. The measured solar concentration characteristics of a 1.8 by 3.7 m lens and its utilization in a solar collection mode are presented. A measured peak concentration ratio of 62 with 90 percent of the transmitted energy focused into a 5.0 cm width was achieved. A peak concentration of 59 and a 90 percent target width of 4.3 cm were analytically computed. The experimental and analytical lens transmittance was 78 percent and 86 percent, respectively. The lens was also interfaced with a nonevacuated receiver assembly and operated in a collection mode. With a natural oxide absorber tube coating ($\alpha/\epsilon = 0.79/0.10$), the measured collection efficiency ranged from 43 percent to 200 C to 34 percent at 260 C. Efficiency improvements to the 40 to 50 percent range can be achieved with second generation lenses and higher performance absorptive coatings.

TM-78223** March 1979
Development, Testing, and Certification of Owens-Illinois Model SEC-601 Solar Energy Collector System — Final Report. John C. Parker. Solar Heating and Cooling Projects Office.

N79-21620

This document summarizes the final results of contract NAS8-32259 with Owens-Illinois, Toledo, Ohio, for the additional

development work on their existing air-cooled solar energy collector subsystem for use with solar heating and cooling systems. It discusses the intended use of the final report, describes the deliverable end items, lists program objectives, relates how they were accomplished, deals with problems encountered during fabrication and testing, and includes a certification statement of performance.

The report shows that the products developed are marketable and suitable for public use.

TM-78224 April 1979
Ion Implantation for Automatic Processing of Integrated Circuits. Bobby W. Kennedy. Electronics and Control Laboratory.

This report presents a discussion of ion implantation including the wafer carriers, mask aligner, hard bake, and loading from a receiving air track into a 10⁻⁷ torr vacuum and unloading onto a sending air track.

TM-78225** April 1979
Solar Tracking Control System "Sun Chaser." D. R. Scott and P. R. White. Electronics and Control Laboratory.
N79-22622

The solar tracking control system ("Sun Chaser") is believed to be an improved method of tracking the Sun in all types of weather conditions. The Sun Chaser will follow the Sun from east to west in clear or cloudy weather, and reset itself to the east position after sundown in readiness for the next sunrise.

The description of the Sun Chaser hardware and its operation together with results is presented.

This report supersedes DOE/NASA TM-78199 in its entirety.

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TM-78227 February 1979
Evaluation of Registration, Compression
and Classification Algorithms — Volume
I (Results). R. Jayroe, R. Atkinson, L.
Callas, J. Hodges, B. Gaggini, and J.
Peterson. Data Systems Laboratory.
N79-27630

Volume one examines the effects that are produced by three registration and seven compression approaches on Landsat imagery and on results obtained from three classification approaches. The registration, compression, and classification algorithms were selected on the basis that such a group would include most of the different and commonly used approaches. The results of the investigation indicate clear-cut, cost effective choices for registering, compressing, and classifying multispectral imagery. Volume two is a programmer's user manual containing IBM-360/75 Fortran listings of the algorithms used in the investigation.

TM-78227 February 1979
Evaluation of Registration, Compression
and Classification Algorithms. Volume 2
(Documentation). R. Jayroe, R.
Atkinson, L. Callas, J. Hodges, B.
Gaggini, and J. Peterson. Data Systems
Laboratory. N79-27631

Volume I examines the effects that are produced by three registration and seven compression approaches on Landsat imagery and on results obtained from three classification approaches. The registration, compression and classification algorithms were selected on the basis that such a group would include most of the different and commonly used approaches. The results of the investigation indicate clear-cut, cost-effective choices for registering, compressing and classifying multispectral imagery. Volume 2 is a programmer's user manual containing IBM-360/75 Fortran listings of the algorithms used in the investigation.

TM-78228 April 1979
Strain Compatibility Assessment for SRB
Sprayable Ablator MSA-1. William J.
Patterson. Materials and Processes
Laboratory. N79-25144

Tensile and compressive strain compatibility testing was performed on as-sprayed samples of the Shuttle Solid Rocket Booster external ablator material, MSA-1. Strain gages on the aluminum substrate were used to monitor strain. Strain compatibility was determined as the percent strain in the substrate at first visual evidence of MSA-1 failure. The 1/8-in. MSA-1, baselined for large areas of the SRB external skin, was characterized by a strain compatibility of 1.5 to 1.8 percent, which far exceeded the yield range of the metal substrate. Thicker MSA-1 applications (1.4 to 3/8 in.) were characterized by a lower level of strain compatibility, which appeared to be a manifestation of application limitations.

TM-78229 June 1979
Ground Winds for Kennedy Space
Center, Florida (1979 Revision). D. L.
Johnson and S. C. Brown. Space Sciences
Laboratory. N79-25662

This report presents revised ground-level runway wind statistics for the Kennedy Space Center, Florida area. Crosswind, headwind, tailwind, and headwind reversal percentage frequencies are given with respect to month and hour for the Kennedy Space Center Space Shuttle runway. This document supersedes NASA TM-78181 and should be used in place of it.

TM-78230 May 1979
Test of Concentrator Solar Array Model
for SEPS. H. H. Huie. Program Develop-
ment. N79-27662

The use of concentrators to improve the performance of solar arrays in deep space was

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tested in a simulated deep space environment. The results of these tests are presented and discussed. Areas of discussion include cell temperature and performance in a low temperature, low illumination environment with and without concentration, concentration ratios, and theoretical analysis versus test results. Tests were conducted on a series/parallel configuration and individual cells.

TM-78231 June 1979
SRB — TPS Spray Nozzle Development for MSA-1 Application. Willibald Peter Prasthofer. Materials and Processes Laboratory. N79-28371

The Materials and Processes Laboratory of the George C. Marshall Space Flight Center has developed a new spray nozzle system for the Marshall Sprayable Ablator (MSA-1) material. In developmental work using a standard automatic spray gun, the spray jet disintegrated before impacting the workpiece and formed an undesirable overspray at the outer zone of the spray pattern. This disintegration of the spray jet was caused primarily by the radically different densities of the 10 ingredients of MSA-1 and design of the nozzle. Improperly sprayed MSA-1 has nonoptimum thermal properties and exhibits debonding of subsequently sprayed MSA-1. Prior to this development, overspray was mechanically scraped off before spraying the next band. Several different devices to suppress overspray were proposed, designed, and tested before developing a nozzle based on the convergent-divergent Laval principle. A nozzle system of this type was first described for the design of steam turbines by Carl Patrick Gustaf de Laval, a Swedish engineer. A significant departure from theory, in our design, is the divergent bell shaped chamber instead of a straight cone as described by de Laval. This MSFC-developed nozzle provided a superior spray pattern, suppressed the overspray to an acceptable level, and produced

a homogeneous jet of MSA-1 that adhered well to the substrate. This development provides a substantial cost and time saving by permitting a continuous spray operation.

TM-78232 July 1979
An Evaluation of Grease Type Ball Bearing Lubricants Operating in Various Environments (Status Report No. 4). E. L. McMurtrey. Materials and Processes Laboratory. N79-27515

Because many future spacecraft or space stations will require mechanisms to operate for long periods of time in environments which are adverse to most bearing lubricants, a series of tests is continuing to evaluate 33 grease type lubricants in R-4 size bearings in five different environments for a 1-year period. Four repetitions of each test are made to provide statistical samples. These tests have also been used to select four lubricants for 5 year tests in selected environments with five repetitions of each test for statistical samples. At the present time, 85 test sets have been completed and 22 test sets are underway. Three 5-year tests have already been started in (1) continuous operation and (2) start-stop operation, with both in vacuum at ambient temperatures, and (3) continuous operation at 93.3°C. To date, in the 1 year tests, the best results in all environments have been obtained with a high viscosity index perfluoroalkylpolyether (PFPE) grease.

TM-78233 July 1979
Surface to 90 km Winds for Kennedy Space Center, Florida, and Vandenberg AFB, California. D. L. Johnson and S. C. Brown. Space Sciences Laboratory. N79-28847

This report presents bivariate normal wind statistics for a 90 degree flight azimuth, from 0 through 90 km altitude, for Kennedy Space Center, Florida, and Vandenberg AFB, California. Wind probability distributions and

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statistics for any rotation of axes can be computed from the five given parameters \bar{u} , \bar{v} , $S(u)$, $S(v)$, and $R(uv)$. This document supersedes NASA TMX-64771 and TMX-64897 and should be used in place of them. There is no intent to automatically change any references to the previous documents in contract scopes of work by the issuance of the 1979 revision of this document.

TM-78234 July 1979
Early Space Experiments in Materials Processing. Robert J. Naumann. Space Sciences Laboratory. N79-28192

This volume represents a comprehensive survey of the flight experiments conducted in conjunction with the United States Materials Processing in Space Program. Also included are a brief description of the conditions prevailing in an orbiting spacecraft and the research implications provided by this unique environment. The purpose of this document is to summarize what has been done and what has been learned in order to serve as a background for future experiments. It is assumed that the reader has some knowledge of the physical sciences but no background in spaceflight experimentation or in the materials sciences per se. The document is expected to serve as an introduction to the Materials Processing in Space Program for investigators in many different fields who might wish to use the unique aspects of spaceflight to further their own research efforts.

TM-78236 August 1979
HEAO-C Observatory Description. Carroll Dailey and Thomas A. Parnell. Space Science Projects Office.

This report presents an abbreviated description of the High Energy Astronomy Observatory (HEAO-C) Program, including spacecraft subsystems, scientific instrumentation, and the mission operations concept. Also, scientific participants such as

Principal Investigators and Co-investigators are presented. This report is prepared as an aid to HEAO Guest Observers. Most of the material relating to the scientific instruments has been supplied by the investigators.

TM-78237 July 1979
Results of Coronal Hole Research: An Update. Robert M. Wilson. Space Sciences Laboratory.

As a continuing effort, the author updates his previous overview of coronal hole research results (NASA TM X-73317, July 1976) to include annotated abstracts of some 220 papers. This report stresses results for the period 1976-1978.

TM-78238 September 1979
Computer Program Development and User's Manual for Program PARACH. Hughlen I. Murphree.

A user's manual is provided for program PARACH, a Fortran digital computer program operational on the Univac 1108. A description of the program and operating instructions for it are included. Program PARACH has been extensively used to study the interaction dynamics of a parachute and its payload during terminal descent. Operating instructions, required input data, program options and limitations, and output data are described. Subroutines used in this program are also listed and explained.

TM-78239 July 1979
Optimum Repair Level Analysis (ORLA) for the Space Transportation System (STS). W. R. Henry. Shuttle Projects Office.

This memorandum presents an adaptation of the Air Force ORLA method to a Space Shuttle Scenario. The Air Force designation and abbreviation style for cost equations have been retained. Those equations

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having the identical definitions as applied by the Air Force retain identical abbreviations; however, their constants may have been changed to fit the Space Shuttle Scenario. The "vendor repair" cost buildup and many cost equations and methods were originated to suit requirements of this scenario which are not addressed by the Air Force publication. As with the Air Force ORLA, only those costs which discriminate between repair alternates are considered.

TM-78300 May 1979
Thermal Control of High Energy Nuclear Waste, Space Option. Jerry A. Peoples. Preliminary Design Office.
N79-25869

A discussion is presented which relates to the thermal and packaging problems of space disposal of nuclear waste material. An approach is suggested which solves both of these problems with emphasis on high energy density waste material. A passive cooling concept is presented utilizing conduction rods which penetrate the inner core. Data are presented which illustrate the effectiveness of cooling rods and the limit of their capability. A computerized thermal model is discussed and developed for the cooling concept:

TM-78301 June 1979
The Space Telescope Observatory. John N. Bahcall and C. R. O'Dell.
N79-27043

This review provides a convenient guide to the expected characteristics of the Space Telescope Observatory for astronomers and physicists. We have tried to provide enough detail so that a professional scientist, observer or theorist, can plan how the observatory may be used to further his observing program or to test theoretical models. Further detail is available in NASA documents that are referenced throughout this report.

TM-78302 June 1978
SCATS — SRB Cost Accounting and Tracking System Handbook. Ross B. Zorn, Rodney D. Stewart, Gary Coley, and Marie Higginbotham. Systems Analysis and Integration Laboratory and Computer Services Office. N79-27002

This technical memorandum describes the Solid Rocket Booster Cost Accounting and Tracking System (SCATS) which is an automatic data processing system designed to keep a running account of the number, description, and estimated cost of Level II, III, and IV changes. Although designed specifically for the Space Shuttle Solid Rocket Booster Program, the ADP system can be used for any other program that has a similar structure for recording, reporting, and summing numbers and costs of changes. The program stores the alpha-numeric designators for changes, government estimated costs, proposed costs, and negotiated value in a MIRADS (Marshall Information Retrieval and Display System) format which permits rapid access, manipulation, and reporting of current change status. Output reports listing all changes, totals of each level, and totals of all levels, can be derived for any calendar interval period.

TM-78303 June 1979
Apollo Telescope Mount — A Partial Listing of Scientific Publications and Presentations, Supplement 3. Edited by John M. Reynolds, Stanley A. Fields, and William C. Snoddy. Space Sciences Laboratory. N79-27500

This report supplements NASA TM X-73300, NASA TM X-73393, and NASA TM-78183. These reports are compilations of bibliographies from the principal investigator groups of the Apollo Telescope Mount (Skylab solar observatory facility) that gathered data from May 28, 1973, to February

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8, 1974. The analysis of these data is presently under way and is expected to continue for several years.

The publications listed in this report are divided into the following categories: (1)

Journal Publications, (2) Journal Publications Submitted, (3) Other Publications, (4) Presentations — National and International Meetings, and (5) Other Presentations. An author index is included together with errata for previous reports.

*Blue cover reports printed at Langley.

**DOE/NASA reports.

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TP-1072

November 1977

The Mechanics of Atmospheric Systems
Derived through Vertical and Horizontal
Analysis of Parametric Data. Robert E.
Turner. Space Sciences Laboratory.

N78-15641

For 36 hours during April 1975, an Atmospheric Variability Experiment was conducted. This research effort supported an observational program in which rawinsonde data, radar data, and satellite data were collected from a network of 42 stations east of the Rocky Mountains at intervals of 3 hours. This program presents data with a high degree of time resolution over a spatially and temporally extensive network.

Reduction of the experiment data is intended primarily as a documentation of the checking and processing of the data and should be useful to prospective users. Various flow diagrams of the data processing procedures are described, and a complete summary of the formulas used in the data processing is provided. A wind computation scheme designed to extract as much detailed wind information as possible from the unique experiment data set is discussed in detail. Estimates of the accuracy of the thermodynamic and wind data are presented. Estimates of errors in the thermodynamic and wind data are given together with a discussion of how these errors affect the final processed data.

Analysis of pressure, height, and temperature on constant pressure charts at 3-hour intervals shows that large-scale features with amplitudes only half the values of commonly cited observational uncertainties exhibit space and time continuity. Examination of 3-hour tendencies of important meteorological variables indicates that they typically exceed measurement uncertainties, may often be inadequately represented by interpolation of 12-hour

observations, and exhibit appreciable spatial variation. Time cross sections in the lower troposphere constructed from the 3-hour observations reveal features with scales of motion not seen by the meteorologist in routine operations (except for regional 3-hour surface maps); horizontal and temporal scales of motion encompass a major portion of the mesoscale, and vertical scales encompass variations as small as 0.3 km. The detailed wind profile data of the experiment resolve the mesoscale wind structure of the lower stratosphere consistent with the findings of other investigators.

An initial method of analysis of satellite image data is presented. It is based on the application of densitometry techniques whereby the field of density of the satellite image is correlated with the associated meteorological events. This work represents an initial attempt to analyze Synchronous Meteorological Satellite (SMS) images with the densitometry methods in the context of mesoscale phenomena.

TP-1354

December 1978

Sequential High-Resolution Wind Profile
Measurements. D. L. Johnson and W. W.
Vaughan. Space Sciences Laboratory.

N79-14680

Tropospheric flow and lower stratospheric flow as measured by 94 sequences of high-resolution Jimsphere balloon data are presented and discussed. The 70 and 24 sequential series are presented for the Kennedy Space Center, Florida, and Point Mugu, California, areas, respectively. Supplemental data, consisting of the associative temperature profiles and the surface and 200 mb synoptic maps, are also presented. The measurements are discussed relative to both the engineering and disciplinary areas. An initial subjective analysis of mesoscale features observed on some sequences is presented.

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TP-1357 November 1978
Atmospheric Effects on CO₂ Laser
Propagation. S. S. R. Murty and J. W.
Bilbro. Electronics and Control Labora-
tory. N79-13607

This report is concerned with the losses encountered in the propagation of CO₂ laser radiation through the atmosphere, particularly as it applies to the NASA/Marshall Space Flight Center Pulsed Laser Doppler System. As such it addresses three major areas associated with signal loss: molecular absorption, refractive index changes in a turbulent environment, and aerosol absorption and scattering. In particular, the molecular absorption coefficients of carbon dioxide, water vapor, and nitrous oxide are calculated for various laser lines in the region of 10.6 μm as a function of various pressures and temperatures. The current status in the physics of low-energy laser propagation through a turbulent atmosphere is presented together with the analysis and evaluation of the associated heterodyne signal power loss. Finally, aerosol backscatter and extinction coefficients are calculated for various aerosol distributions and the results incorporated into the signal-to-noise ratio equation for the Marshall Space Flight Center system.

TP-1359 December 1978
Engineering Handbook on the Atmos-
pheric Environmental Guidelines for Use
in Wind Turbine Generator Develop-
ment. Walter Frost, B. H. Long, and R. E.
Turner. Space Sciences Laboratory.
N79-14679

Atmospheric environmental guidelines for use in wind turbine generator development are presented. The guidelines are given in the form of design criteria relative to wind speed, wind shear, turbulence, wind direction, ice and snow loading, and other climatological parameters which include rain, hail, thermal effects, abrasive and corrosive effects, and

humidity. This report is not a discussion of fundamental concepts or theories, but a presentation of design criteria in an engineering format which can be directly input to wind turbine generator design computations.

A summary section in each chapter provides a range of recommended design values for a general purpose, "off-the-shelf-type" wind turbine generator which could be sited in most any region of the United States. Following these summarized design values, detailed computational procedures and working data are provided which allow the designer to establish his own design values if desired. Thus, guidelines are also provided for developing specialized wind turbine generators or for designing wind turbine generators which are to be used in a specific region of the United States.

TP-1371 December 1978
Eulusmap; an International Land
Resources Map Utilizing Satellite
Imagery. T. Paludan and E. Csáti. Earth
Resources Office, Science and Engineer-
ing. N79-13475

In 1972, the International Geographical Union's Commission on World Land Use Survey adopted a project for a land-use map of Europe. Such a map, under the name "Eulusmap," had been started earlier under sponsorship of several government offices in Hungary. Although there was great response from a number of contributors in many countries, it became evident by mid-1974 that the map would contain gaps and some inaccuracies unless additional data sources were utilized. By then, the satellite Landsat-1 had obtained imagery of most of Europe. Using theme extraction techniques, the map was completed in draft form and portions of it displayed at the 23rd International Geographical Congress in Moscow during July 1976. Printing of the completed map was accomplished in May 1978.

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A comprehensive standard land-use classification system was established in 1949. A goal of world mapping at a scale of 1:1 million was also set, but remains far from realization. The advent of satellite data makes achievement possible, but only if some compromises are made in the classification system. It is now realistic to map land resources of large areas and regions undergoing rapid change. This is especially important in developing areas of the world.

TP-1383 December 1978
Characterization of Large 2219 Aluminum Alloy Hand Forgings for the Space Shuttle Solid Rocket Booster. M. W. Brennecke. Materials and Processes Laboratory. N79-16950

This report presents the mechanical properties, including fracture toughness, and stress corrosion properties of four types of 2219-T852 aluminum alloy hand forgings. Weight of the forgings varied between 450 and 3500 lb at the time of heat treatment and dimensions exceeded the maximum covered in existing specifications. Dimensions ranged from approximately 5¼ to approximately 16¼" thick, 10½ to 29½" wide and 33 to 115½" long at heat treatment. The forgings were destructively tested to develop reliable mechanical property data to replace estimates employed in the design of the Space Shuttle Solid Rocket Booster (SRB) and to establish minimum guaranteed properties for structural refinement and for entry into specification revisions. The report summarizes data required from the forgers and from the SRB Structures contractor. Specific technical requirements for testing were defined; testing was coordinated; and results were organized, analyzed and evaluated by the Materials and Processes Laboratory of the George C. Marshall Space Flight Center.

TP-1384 December 1978
Space Shuttle Afterbody Aerodynamics/
Plume Simulation Data Summary.
Kenneth L. Blackwell and Leroy M. Hair.
Systems Dynamics Laboratory.
N79-17810

A series of parametric wind tunnel tests was conducted to provide a base for developing a simulation of afterbody/base aerodynamics for multibody/multibase rocket-powered vehicles (such as Space Shuttle) which use unheated air as the simulant gas in development wind tunnel tests. The tests described herein were parameterized on external configuration, nozzle internal configuration, base geometry, propulsion gas type (air, CF₄, solid propellant exhausts), and freestream Mach number (0.5 to 3.5). These tests were conducted over a 4-year period in the MSFC 14-Inch Trisonic, AEDC-PWT-4T, and Ames 11-Foot wind tunnels. Presented in this report are the data and pertinent reference information necessary to perform an analysis which would lead to a simulation procedure. The type of data obtained during the tests described herein include model base, afterbody, and nozzle internal surface static pressure distributions, model chamber pressure and temperature, and freestream conditions. Also included is a brief description of simulation procedures that have been used by the Space Shuttle program.

TP-1389 January 1979
Summary of Atmospheric Wind Design
Criteria for Wind Energy Conversion
System Development. Walter Frost and
Robert E. Turner. Space Sciences
Laboratory. N79-14678

This report presents basic design values of significant wind criteria, in graphical format,

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for use in the design and development of wind turbine generators for energy research. It is a condensed version of portions of the "Engineering Handbook on the Atmospheric Environmental Guidelines for Use in Wind Turbine Generator Development," NASA TP-1359, 1978.

TP-1417 February 1979
Management System, Organizational
Climate and Performance Relationships.
Bervil D. Davis. Program Planning
Office. N79-19912

This study investigated seven aerospace firms to determine if a relationship existed among management systems, organizational climate, and organization performance. Positive relationships were found between each of these variables, but a statistically significant relationship existed only between the management system and organizational climate. The direction and amount of communication and the degree of decentralized decision-making, elements of the management system, also had a statistically significant relationship with organization performance.

NASA CONTRACTOR REPORTS
(Abstracts for these reports may be obtained from STAR)

- CR-3041 August 1978
Applications of Remote Sensing to Hydrologic Planning. Harry Loats, Jr., Thomas Fowler, and Peter Castruccio. NAS8-32423. ECOSystems International, Inc. N78-32526
- CR-3051 September 1978
Studies of Convection in a Solidifying System with Surface Tension at Reduced Gravity. Basil N. Antar and Frank G. Collins. NAS8-32484. University of Tennessee Space Institute. N78-32386
- CR-3052 September 1978
Investigations of Simulated Aircraft Flight through Thunderstorm Outflows. Walter Frost and Bill Crosby. NAS8-32217. FWG Associates, Inc. N78-32037
- CR-3073 December 1978
Investigation of Aircraft Landing in Variable Wind Fields. Walter Frost and Kapuluru Ravikumar Reddy. NAS8-29584. University of Tennessee Space Institute. N79-13643
- CR-3076 December 1978
Current Research on Aviation Weather (Bibliography). Don E. Durham and Walter Frost. NAS8-29584. University of Tennessee Space Institute. N79-17434
- CR-3084 December 1978
Studies of Vorticity Imbalance and Stability, Moisture Budget, Atmospheric Energetics, and Gradients of Meteorological Parameters During AVE III. Edited by James R. Scoggins. NAS8-31773. Department of Meteorology, Texas A&M University. N79-14676
- CR-3085 December 1978
Hygroscopic Chemicals and the Formation of Advection Warm Fog — A Numerical Simulation. R. J. Hung and G. S. Liaw. NAS8-31729. The University of Alabama in Huntsville. N79-14677
- CR-3095 January 1979
A Field Study of Air Flow and Turbulent Features of Advection Fog. J. D. Connell. NAS8-32031. University of Tennessee Space Institute. N79-15513
- CR-3129 April 1979
Frost Formation on an Airfoil: A Mathematical Model I. Mark Dietenberger, Prem Kumar, and James Luers. NAS8-31294. University of Dayton Research Institute. N79-22706
- CR-3150 June 1979
Differences between Measured and Linearly Interpolated Synoptic Variables over a 12-h Period during AVE IV. Leonard R. Dupuis and James R. Scoggins. NAS8-31773. Department of Meteorology, Texas A&M University. N79-25670
- CR-3158 July 1979
Particle Dynamics Associated with the Spacelab Environment. V. A. Sandborn. NAS8-31688. College of Engineering, Colorado State University. N79-28471
- CR-3166 August 1979
Kinetic Energy Budgets in Areas of Convection. Henry E. Fuelberg. NAS8-32838. Department of Earth and Atmospheric Sciences, Saint Louis University. N79-28850
- CR-150812** July 1978
Thermal Energy Storage Subsystems (Quarterly Reports). NAS8-32254. Artech Corp. N79-10517

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| Development of Surfaces Optically Suitable for Flat Plate Solar Panels (Final Report). NAS8-32481. | | SIMS Prototype System 4 Performance Test Report. NAS8-32036. IBM. | |
| | | | N79-13499 |
| CR-150814** | August 7, 1978 | CR-150821 | June 1978 |
| Solar System Installation at Louisville, Kentucky (Final Report). ERDA Contract E(49-18)-2385. Rademaker Corp. | | Transistor Step Stress Testing Program, Final Report. NAS8-31944. DCA Reliability Laboratory. | |
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| Long Term Weathering Effects on the Thermal Performance of the Lennox/Honeywell (Liquid) Solar Collector. NAS8-32036. Wyle Laboratories. | | Trends and Techniques for Space Base Electronics, Quarterly Report. NAS8-26749. Mississippi State University. | |
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| CR-150819** | June 6, 1978 | CR-150826 | September 1978 |
| Thermal Performance Evaluation of the Calmac (Liquid) Solar Collector. NAS8-32036. IBM. | | Development of Base Pressure Similarity Parameters for Application to Space Shuttle Launch Vehicle Power-On Aerodynamic Testing, Final Report. NAS8-32658. Lockheed Missiles and Space Co., Inc. | |
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N79-12552

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N79-12549

CR-150830* October 1978
Prototype Solar Heating and Cooling Systems. NAS8-32091. AiResearch Mfg. Co.
N79-12551

CR-150831 September 1978
Development of Surfaces Optically Suitable for Flat Solar Panels, Final Report. NAS8-32481. University of Alabama in Huntsville.
N79-10522

CR-150832 September 15, 1978
Design, Processing and Testing of LSI Arrays Hybrid Microelectronics Task, Final Report. NAS8-32607. Hughes Aircraft Co.
N79-10341

CR-150833 June 1978
Load and Dynamic Assessment of B-52B-008 Carrier Aircraft for Finned Configuration 1 Space Shuttle Solid Rocket Booster Decelerator Subsystem Drop Test Vehicle, Volume 1 - Summary. NAS8-31805. Boeing Co.
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CR-150834 June 1978
Load and Dynamic Assessment of B-52B-008 Carrier Aircraft for Finned Configuration 1 Space Shuttle Solid Rocket Booster Decelerator Subsystem Drop

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N79-10049

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N79-10050

CR-150836 June 1978
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N79-10051

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N79-14499

CR-150838 August 31, 1978
Design of a Low Cost Earth Resources System, Final Report. NAS8-32397. Georgia Institute of Technology.
N79-16323

CR-150839** November 1978
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N79-16361

CR-150840** November 1978
System Design Package for SIMS Prototype System 3, Solar Heating and Domestic Hot Water. NAS8-32036. IBM Federal Systems Division.
N79-16359

*See notation page 42

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| GREENWOOD, TERRY | ED33 | |
| SMITH, S. | | |
| Lockheed Missiles & Space Co., Inc. Development of a Shear Layer Mixing Model for Large Solid Rocket Motors. For presentation at the JANNAF 11th Plume Technology Meeting to be held at Huntsville, Alabama on May 8-10, 1979. | | |
| SHACKELFORD, BENJAMIN W. | EP25 | |
| CAVENY, LEONARD H. | | Princeton Univ. |
| KUO, KENNETH K. | | Penn State Univ. |
| Ignition Transients of the Space Shuttle SRM. For publication in the Proceedings of the 1979 JANNAF Propulsion Meeting which was held in Anaheim, California on March 5-8, 1979. | | |
| SHIPMAN, DAVID L. | EL12 | |
| Payload Specialist Training Scheduler (PACTS). For presentation at the AIE Annual Institute Conference to be held in Atlanta, Georgia on May 11-14, 1980. | | |
| SMITH, J. B., JR. et al. | ES52 | |
| Vector Magnetic Measurements of an Active Region. For presentation at the 154th Meeting of the American Astronomical Society to be held June 11-14, 1979. | | |
| SMITH, R. E. | ES81 | |
| HUNG, R. J. | UAH | |
| PHAN, T. | UAH | |
| SMITH, R. E. | ES81 | |
| HUNG, R. J. | UAH | |
| PHAN, T. | UAH | |
| Coupling of Ionosphere and Troposphere During the Occurrence of Isolated Tornadoes on November 20, 1973. For publication in the Journal of Geophysical Research. | | |
| SMITH, R. E. | ES81 | |
| HUNG, R. J. | UAH | |
| PHAN, T. | UAH | |
| Ionosphere and Satellite Remote Sensing of Tornadoic Storms. For presentation at the Thirteenth International Conference on Remote Sensing of the Environment to be held in Ann Arbor, Michigan on April 23-27, 1979. | | |
| SNODDY, WILLIAM C. | PS01 | |
| NEIN, MAX E. | PS01 | |
| Space Platforms — An Evolutionary Approach for Long Duration Space Science and Applications Missions. For presentation at the 1979 Annual Meeting of the American Astronautical Society to be held in Los Angeles, California on October 29-November 2, 1979. | | |
| STEELY, SIDNEY L. | | FWG Associates, Inc. |
| FROST, WALTER | | University of Tennessee Space Institute |
| CAMP, DENNIS W. | ES82 | |
| Statistical Analysis of Atmospheric Flow About a Simulated Block Building. For presentation at the 5th International Wind Engineering Conference to be held at Fort Collins, Colorado in July 1979. | | |

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are presentation dates.)

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| STERRETT, JAMES B. | ET01 | URBAN, E. W. | ES63 |
| Large Scale Vibration Testing of Engineering Structures. For presentation at the U. S. National Conference on Earthquake Engineering to be held at Sanford, California on August 22-24, 1979. | | KATZ, L. | ES63 |
| | | HENDRICKS, J. B. | UAH |
| | | KARR, G. R. | UAH |
| | | The Spacelab 2 Infrared Telescope Cryogenic System. For presentation at the Electro-Optical Technical Symposium and Workshop to be held in Huntsville, Alabama on May 22-25, 1979. | |
| STEWART, RODNEY D. | EL02 | URBAN, EUGENE | ES63 |
| Format and Content of Cost Information Required in Proposals. For presentation at the Second Annual Conference of the National Estimating Society to be held in Los Angeles, California on June 18-19, 1980. | | KATZ, LESTER | ES63 |
| | | HENDRICKS, J. | UAH |
| | | KARR, G. | UAH |
| TANDBERG-HANSEN, E. | ES51 | Cryogenic Helium II Systems for Space Applications. For presentation at the International Symposium on Spacecraft Thermal and Environmental Control Systems to be held at Munich, Germany on October 10-12, 1978. | |
| Ejection of Mass from the Sun. For presentation at the Indo-U. S. Workshop on Solar-Terrestrial Physics to be held in Udaipur, India on June 12-16, 1979. | | | |
| TANDBERG-HANSEN, EINAR | ES51 | VAN RENSSLAER, FRANK | FA51 |
| Formation, Support and Stability of Quiescent Prominences. For presentation at the IAU Colloquium 44, "The Physics of Solar Prominences" to be held at Oslo, Norway on August 14-18, 1978. | | ROHRBAUGH, DAVID J. | |
| | | Boeing Aerospace Co. | |
| | | The Inertial Upper Stage — Workhorse of the Future. For presentation at the Thirtieth International Astronautical Federation Congress to be held in Munich, Germany on September 16-23, 1979. | |
| TANDBERG-HANSEN, E. | ES51 | VAUGHAN, O. H. | ES83 |
| HENZE, W. Teledyne Brown Engineering Polarimetry with the SSM Ultraviolet Spectrometer and Polarimeter. For presentation at the Workshop on Flare Research and Solar Maximum Mission to be held at Ann Arbor, Michigan on November 13-16, 1978. | | HUNG, R. J. | UAH |
| | | LIAW, G. S. | UAH |
| | | Aerosol Particles and the Formation of Advection Fog. For publication in the Journal Research Atmospheric (France). | |
| TEUBER, D. L. | ES51 | VAUGHAN, O. H. | ES83 |
| A Unifying Analytic Method for Solar Flare Data, Sunspot Numbers, and a Stellar Observation. For publication in Solar Physics (Holland). | | VONNEGUT, BERNARD | |
| | | State University of New York at Albany | |

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are presentation dates.)

- Thunderstorm and Lightning Observations from Space Shuttle. For publication in the Bulletin of the American Meteorological Society and for presentation at the IEE/AIAA Conference on Space Instrumentation for Atmospheric Observation to be held in El Paso, Texas on April 3-5, 1979.
- VAUGHAN, WILLIAM W. ES81
Lightning and Space Observations Potential. For publication in the AIAA Alabama Section Explorer periodical.
- VINZ, FRANK L. EF41
Simulation for Development of Free-Flying Service Vehicles. For presentation at the 1979 Annual Meeting of the AAS to be held in Los Angeles, California on October 29-November 1, 1979.
- VON TIESENHAUSEN, GEORG F. PS01
Nonterrestrial Processing and Manufacturing of Large Space Systems. For presentation at the 24th National Symposium of the Society for the Advancement of Material and Process Engineering to be held in San Francisco, California on May 8-10, 1979.
- WARMBROD, JOHN D. ED33
Design and Development of the Thermal Protection System for the External Tank For presentation at the AIAA 12th Fluid and Plasma Dynamics Conference to be held in Williamsburg, Virginia on July 23-25, 1979.
- WATTERS, H. H. EL15
STOKES, J. W. EL15
Construction in Space. For publication in Astronautics and Astronautics Journal.
- WEISSKOPF, M. C. ES61
The Search for, and Study of, Black Holes in the Galaxy. For publication in the Proceedings of the NASA Compact Objects Workshop which was held in Washington, D. C. on April 20-21, 1979.
- WEISSKOPF, M. C. ES62
DARBRO, W. ES62
ELSNER, R. NAS/NRC Fellow
GHOSH, P. NAS/NRC Fellow
SUTHERLAND, P. Alfred P. Sloan Fellow
HERTZ, P.
VIANNA, G.
GRINDLAY, J.
Results from the Monitor Proportional Counter Aboard the Einstein Observatory: High Time Resolution Studies of Cygnus X-1, X-2, and X-3. For presentation at the 1979 Spring Meeting of the American Physical Society to be held in Washington, D. C. on April 23-26, 1979 and for publication of the Bulletin of the American Physical Society.
- WEISSKOPF, M. C. ES61
SUTHERLAND, P. G. ES61
On the Time Variability of Circinus X-1: A Comparison with Cygnus X-1. For publication in the Astrophysical Journal.
- WESTROPE, DOUGLAS W., JR. FA33
Solar Energy Works Profitably on a North Georgia Project. For presentation in the Solar Heating and Cooling Operational Results Conference to be held in Colorado Springs, Colorado on November 27-30, 1979.
- WILKES, D. R. ES64
BROWN, M. J. Aerojet Electric Co.
An Active Thermal Control Surfaces

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(Available only from authors. Dates are presentation dates.)

- Experiment (TCSE). For presentation at the AIAA 14th Thermophysics Conference to be held at Orlando, Florida on June 4-6, 1979.
- WILKES, D. R. ES64
HARADA, Y. IIT Research Institute
Inorganic Zn_2TiO_4 Thermal Control Coatings. For presentation at the 24th National SAMPE Symposium to be held in San Francisco, California on May 8-10, 1979.
- WILSON, R. M. ES52
REICHMANN, E. J. ES52
TEUBER, D. L. ES52
SMITH, J. B., JR. NOAA
A Prediction Method for the Soft X-Ray Flux of Solar Flares. For publication in the Solar-Terrestrial Predictions Proceedings.
- WILSON, R. M. ES52
SMITH, J. E. ES52
Physical Parameter Profiles of Selected Solar X-Ray Flares. For publication in Astronomy and Astrophysics.
- WINKLER, CARL E. ES61
KORSCH, DIETRICH ES61
Design of Stigmatic Grazing Incidence Telescopes with Non-Parabolic Primaries. For presentation at the Electro-Optical Technical Symposium and Workshop to be held at Huntsville, Alabama on May 22-25, 1979.
- WOJTALIK, FRED S. EE71
Project HEAO — Revisited. For presentation at the Eighth IFAC World Congress to be held in Kyoto, Japan on August 24-28, 1981.
- WYMAN, CHARLES L. EE01
Huntsville Electro-Optical Technical Symposium and Workshop, SPIE-OSA-AAS. For presentation at the SPIE Symposium Proceedings to be held in Huntsville, Alabama on May 22-25, 1979.
- YOUNG, LEIGHTON E. EC12
Solar Array Technology for Solar Electric Propulsion Missions. For presentation at the International Electric Propulsion Conference (AIAA) to be held at Princeton, New Jersey on October 30-November 1, 1979.
- ZOLLER, LOWELL K. LA01
Commercialization of Space Processing. For presentation at the 1979 AAS Annual Meeting to be held in Los Angeles, California on October 29-November 1, 1979.
- ZOLLER, LOWELL K. LA01
Commercialization of Materials Processing in Space. For presentation at the Sixteenth Space Congress to be held in Cocoa Beach, Florida on April 25-27, 1979.
- ZOLLER, LOWELL K. LA01
Materials Processing — A Matter of Gravity. For presentation at the "Shuttling Into the Next Space Age" to be held at the Alabama Space and Rocket Center, Huntsville, Alabama on July 18-19, 1979.

MSFC CONFERENCE PUBLICATIONS

CP-2069 May 1-2, 1978
Proceedings of the Workshop on an
Electromagnetic Positioning System in
Space. Marshall Space Flight Center.
N79-13069

CP-2075 November 14-16, 1978
Government/Industry Workshop on
Payload Loads Technology. Marshall
Space Flight Center. N79-20162

CP-2083 February 13-15, 1979
Workshop on the Need for Lightning
Observations from Space — Preliminary
Report. University of Tennessee Space
Institute and Marshall Space Flight
Center. N79-21697

CP-2084 February 12, 1979
Laser Doppler Velocimetry Workshop.
Marshall Space Flight Center.
N79-22455

CP-2091 June 1979
Proceedings of Workshops to Define
Engineering Requirements for a Space
Vacuum Research Facility. Marshall
Space Flight Center. N79-26076

CP-2095 February 13-15, 1979
Proceedings: Workshop on the Need for
Lightning Observations from Space.
Marshall Space Flight Center.

APPROVAL

FY 1979 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS, AND PRESENTATIONS

Compiled by O. L. White

The information in this report has been reviewed for technical content. Review of any information concerning Department of Defense or Atomic Energy Commission programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.

A handwritten signature in dark ink, appearing to read "J. T. Shepherd", is written over a horizontal line.

J. T. SHEPHERD

Director, Administration and Program Support